

BioSoundSCape

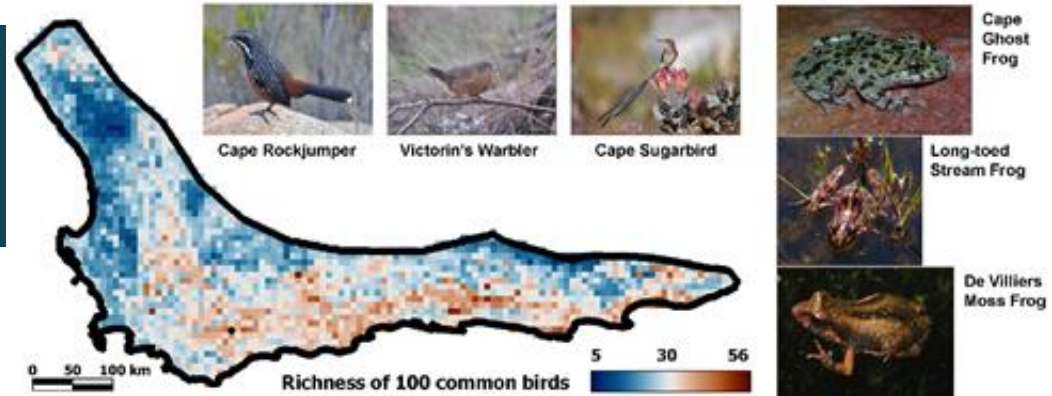
Connecting acoustics and remote sensing to
study animal-habitat diversity across
environmental gradients

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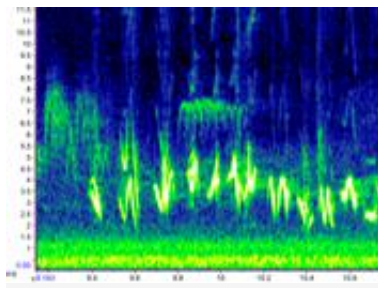
Objectives



- Measure ground-based animal diversity using low-cost autonomous recording units (ARUs) across the Cape Region
- Scale these measurements using remotely-sensed indicators of habitat variation

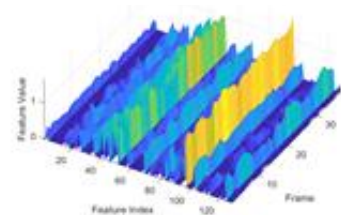
Species Agnostic Acoustic Approach

- Low-cost, automated recorders (AudioMoths)
- Sounds represented as images, called spectrograms
- Acoustic features from indices and from a convolutional neural network



Index name	Abbreviation
Acoustic Complexity Index	ACI
Acoustic Diversity Index	ADI ($=H'$)
Acoustic Evenness Index	AEI
Bioacoustic Index	BI
Temporal Entropy	H_t
Etc.	

VGGish Embeddings



Based on a paper by
Sethi et al., PNAS 2020

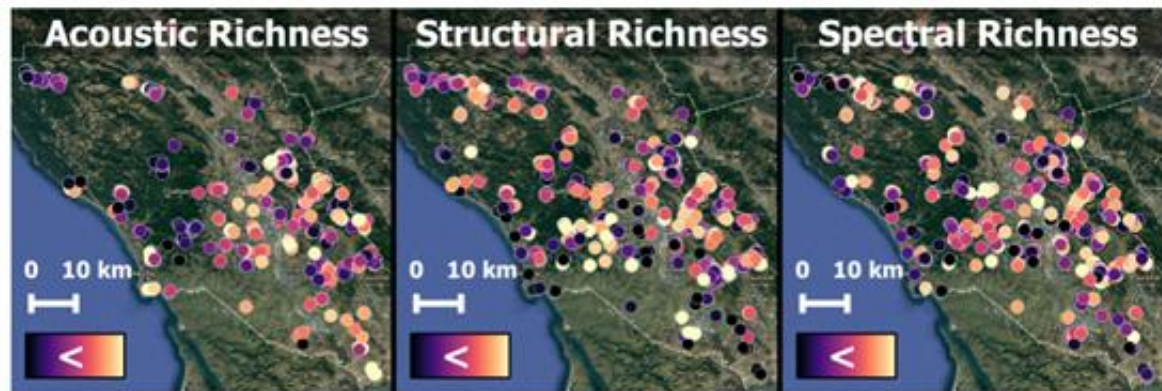
Methods

Measurements

- Bird and amphibian observations (point counts)
- Acoustic (AudioMoth)
- Structure (LVIS)
- Spectral (AVIRIS NG)

Acoustic, structural, spectral diversity estimated using Hutchinson's n -dimensional hypervolume approach

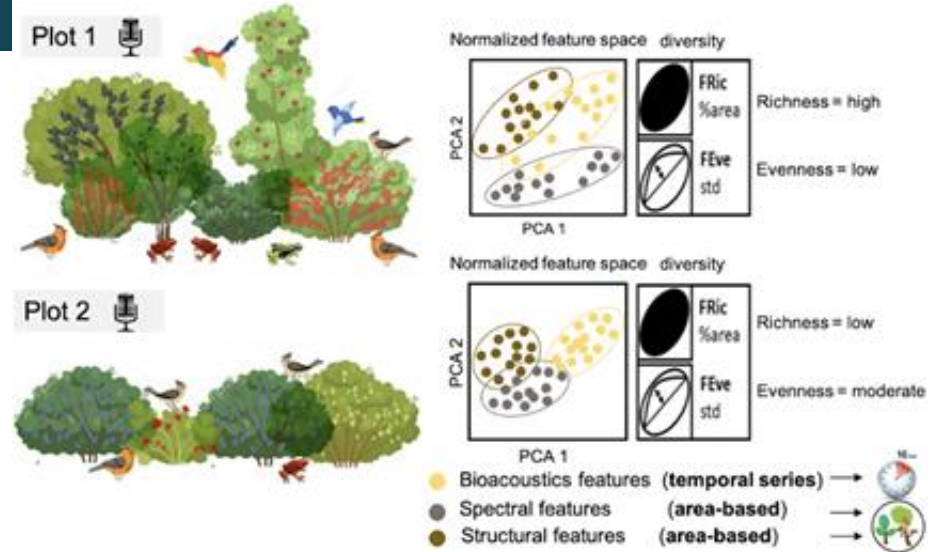
- **richness, evenness, divergence**



Proof-of-concept in a highly diverse Mediterranean biome in Sonoma County, CA (darker color = lower richness)

Research Questions

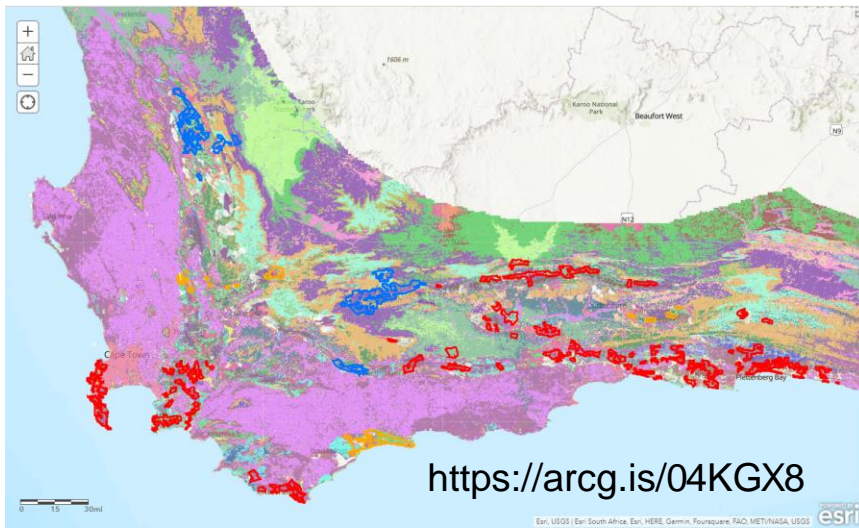
- How is acoustic diversity related to animal diversity (birds and amphibians)?
- What is the relationship among measures of acoustic, spectral and structural diversity and how do those relationships change across spatial scales and vegetation types?



- How do anthropogenic and natural disturbance affect acoustic diversity and habitat quality?

Acoustic Sampling

- Field campaigns led by BirdLife South Africa
- Local volunteers (citizen scientists)
- Wet season (July–August) and dry season (October–November), 2023



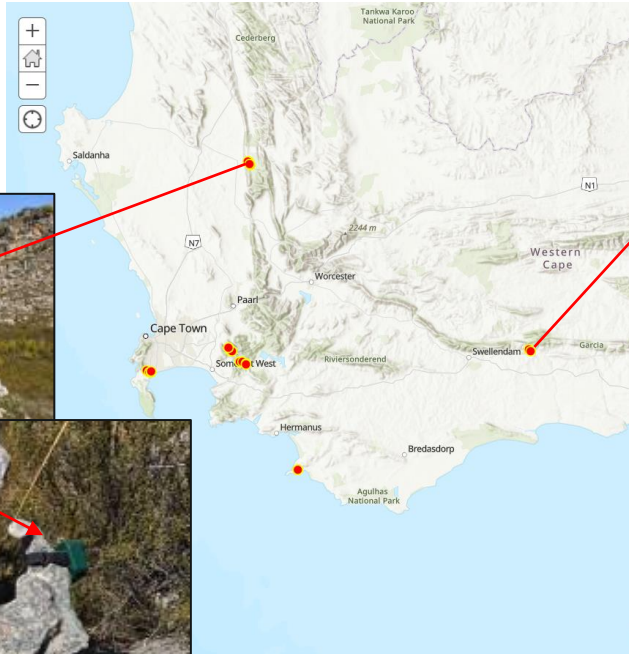
<https://arcg.is/04KGX8>

- Stratification based on property (CapeNature or SANParks), land cover, elevation, fire history, 1-km distance to roads
- We're interested in sampling at BioSCape vegetation plots and other opportunistic sites!

Prototype phase

40 sites
~55,000 Minutes

John Measey, Alan Lee,
and Andrew Turner



Sites

Uploads

Recordings

Species

Sounds

Classes

Training

Templa

Playlist

Create

Edit

Import

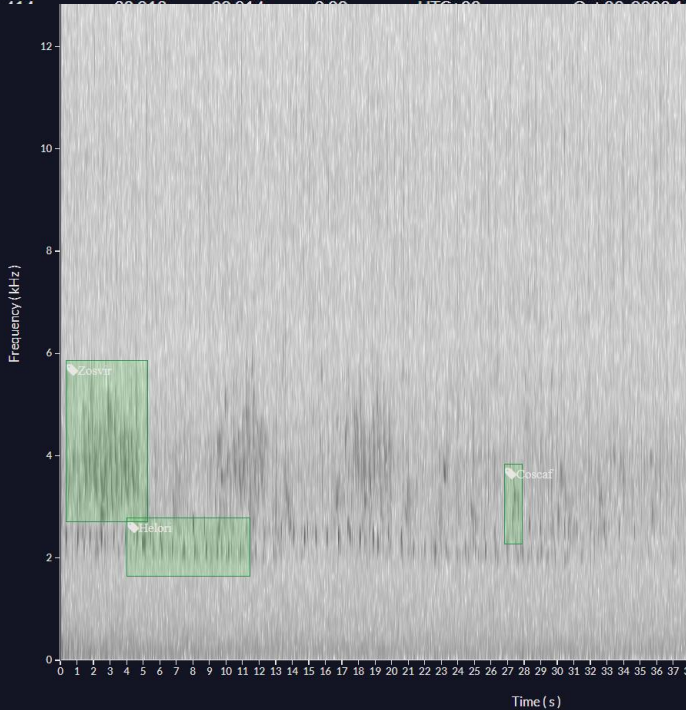
Export Sites

Delete

Search

Name	No. of recordings	Latitude	Longitude	Altitude	Timezone	Last updated
s2lam096_221021	288	-32.006	20.823	0.00	UTC+02	Oct 29, 2022 11:14 PM

s2lam085_221020	111	-32.018	20.814	0.00	UTC+02	Oct 22, 2022 11:14 PM
s2lam085_221020, Oct 22, 2022 3:00 PM						Oct 22, 2022 11:14 PM

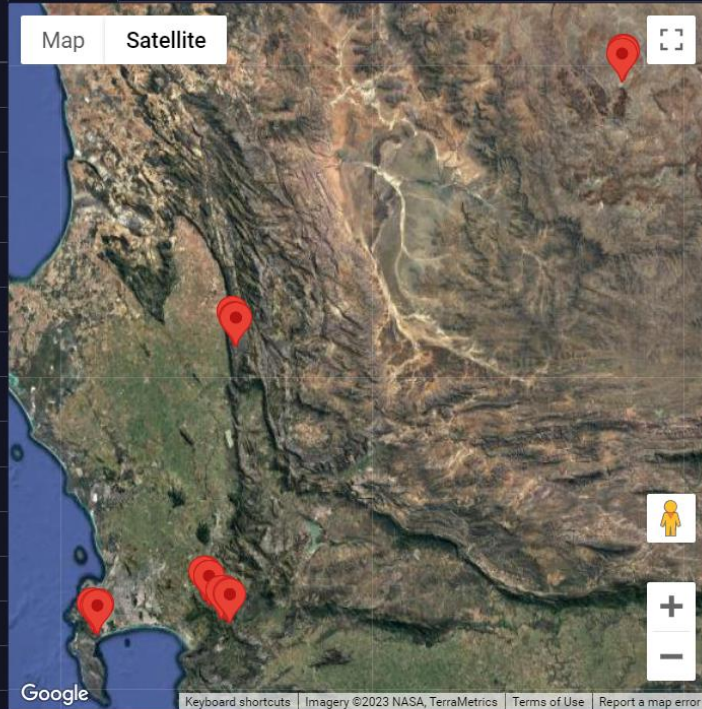


s2lam076_220928	2337	-33.020	19.069	816	UTC+02	Oct 22, 2022 6:05 AM
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Location

Map

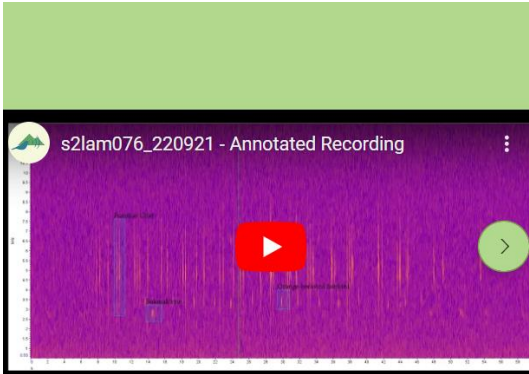
Satellite



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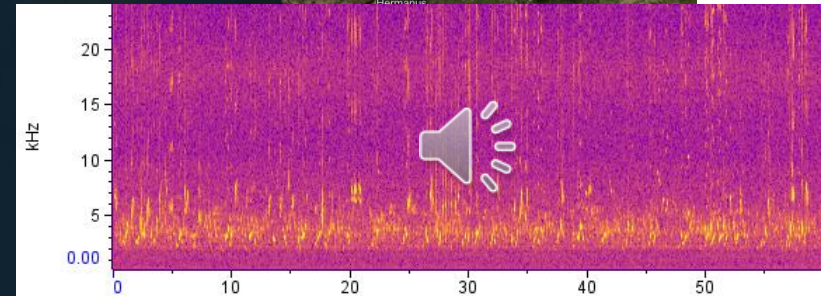
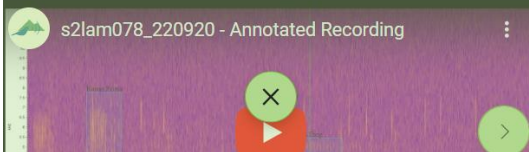
<https://arcg.is/19aXCD0>

Check out our storymap!



s2lam076_220921

Silvermine Nature Reserve within the
Montane Fynbos and Renosterveld
ecoregion



Assegaai Nature Reserve, Stellenbosch